

Appl. No. 10/604,404  
Response dated January 3, 2006

### **REMARKS**

By this amendment, the specification is amended to correct a typographical error and claims 15-17 are amended. Claims 1-19 are pending in the application. Claims 1-18 have been rejected as obvious in view of Grotz, Jr. as modified by JP 6-159931, and claims 15-17 as indefinite. Claim 19 stands withdrawn as directed to a non-elected invention. Further examination of the application, as amended, reconsideration of the rejections, reconsideration of the restriction requirement and/or rejoinder of claim 19, and allowance of all pending claims are respectfully requested.

The specification is amended to correct a typographical error in the US patent number for the Grotz, Jr. reference. The same error was repeated in the respective information disclosure statement, and correction of the reference citation is also respectfully requested.

Although not believed to be necessary, claims 15-17 have been amended to clarify that these dependent claims include each of the features recited in claim 14 to which they refer, including the underlying process features as well as the improvement features.

The claims of the present invention are directed to ammonia synthesis according to the Braun Purifier-type process with cryogenic autorefrigeration, wherein a liquid bottoms stream from the distillation

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column is expanded through a liquid expander with a work output (claim 1) and the feed to the distillation column is expanded in an adiabatic J-T valve (claim 2). This directly contrasts with the expansion of the feed vapor in a gas-expander 276 with work output in Grotz Jr. and subsequent liquid throttling of the bottoms stream.

Indeed, rather than suggesting expansion with work output of the bottoms stream, at (column/lines) 6/41-42 Grotz, Jr. teaches squarely away from applicant's approach by stating that expansion of the product gas is not as efficient. It is true that expansion of the bottoms stream/waste fluid does in fact produce less work output, confirmed by applicant in the specification at Table 3 and paragraph [0035] (120.40 kW for waste fluid expansion compared to 203.39 kW for raw syngas feed expansion). Grotz, Jr. is thus antithetical; this clear teaching only makes the approach of applicant that much more counterintuitive.

Despite the directly contrary teachings of Grotz, Jr., however, applicant's claimed *liquid* expansion with work output has the rather astonishing result that less pressure drop is required for autorefrigeration in the nitrogen removal operation and as a consequence the power required for makeup compression to the ammonia synthesis loop is substantially lower than in the Grotz, Jr. configuration. The energy saved by recompressing the

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makeup synthesis gas from a higher pressure eclipses the expansion work output.

Moreover, the claimed liquid expansion changes the way the nitrogen removal unit is operated. Liquid expansion allows the liquid level in the distillation column to be controlled by adjusting flow to the liquid bottoms stream expansion (claim 4). The waste fluid from the liquid expander can be mixed vapor and liquid (claim 5) and the warm waste fluid from the overhead vapor cooling can consist entirely of vapor (claim 6), contrasting with the partially vaporized (i.e., mixed vapor-liquid) stream 280 in Grotz, Jr. (7/18-20) and concomitant evaporation in the cross exchangers 278 and/or 272. Furthermore, applicant's liquid expander can be a hydraulic turbine (claim 7).

Because Grotz, Jr. teaches away from the claimed invention, there would have been no motivation for modification according to JP 6-159931 as asserted in the office action. Moreover, even if there were such motivation *arguendo*, the secondary reference still would not obtain applicant's claimed invention since the liquid is first expanded in an adiabatic J-T valve and vaporized in exchanger 2 before turbine expansion of the resulting *gas* at 5. Thus, any liquid expansion would occur without

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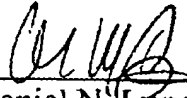
work output. Accordingly, it is respectfully submitted that claims 1-9 are patentable over the references cited.

Claims 10-17 are similarly allowable over the art of record since they also recite the distinguishing features seen in claims 1-9. Means-plus-function claim 18 also recites the distinguishing liquid expansion means corresponding to claim 1 and is likewise allowable. Reconsideration of the restriction requirement and/or rejoinder as to claim 19 is respectfully requested in that it is a linking claim in means-plus-function format paralleling the process steps of allowable claim 10. Moreover, claim 19 also recites the same liquid expansion means that distinguish claim 18, and applicant thus need not rely on any additional features recited in claim 19 (at least with respect to claims 1, 10 and/or 18) to establish patentability. Therefore, no additional searching or burden would be imposed by examining claim 19, which should be allowable over the references cited for the same reasons as claims 1, 10 and/or 18.

Withdrawal of the rejections and the restriction requirement, and allowance of all pending claims, are respectfully requested. Should any issues remain that are appropriate to resolution by telephone interview, please contact undersigned counsel.

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Respectfully submitted,



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